## REMARKS

The Examiner is respectfully requested to enter the above amendments prior to examination of the application. These amendments serve to put the application in better condition for allowance.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "**Version with markings to show changes made**".

In the event that the transmittal letter is separated from this document and the Patent and Trademark Office determines that an extension and/or other relief is required, applicant petitions for any required relief including extensions of time and authorizes the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to **Deposit Account No. 03-1952** referencing docket no. 360842006800.

Respectfully submitted,

Dated: March 21, 2002 By: _____

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## VERSION WITH MARKINGS TO SHOW CHANGES MADE

**In the Specification:**

The specification has been amended as follows:

On page 1, line 5, amend line as follows:

[Technical] Field of the Invention

On page 1, line 11, amend the line as follows:

Background [Art] of the Invention

On page 2, replace the paragraph beginning at line 9 with the following rewritten paragraph:

As a countermeasure against this, for example, thermoplastic particles are adhered to a surface of prepreg to be arranged between the layers of the formed laminate so that the propagation energy of cracks due to impact force is absorbed by breakage of the particles, decreasing the area of delamination. This countermeasure significantly improves the residual compression strength of the FRP plate receiving the impact, [and] which allows FRP [is thus brought into practical use] to be used as a primary structural material for large civil aircraft.

On page 2, replace the paragraph beginning at line 18 with the following rewritten paragraph:

However, this method [has the problem of increasing] increases the production cost of a FRP structural material due to the following causes[.] :

On page 2, replace the paragraph beginning at line 24 with the following rewritten paragraph:

B. Since the particles are uniformly adhered to the resin surface of the prepreg, the working speed of the prepreg is decreased, or another new step is required for forming a resin film in which the particles are dispersed in a matrix resin in the B-stage state.

On page 3, replace the paragraph beginning at line 4 with the following rewritten paragraph:

C. The particles enter the prepreg or the FRP layers after the resin of the prepreg is cured according to the production and molding conditions of the prepreg[, thereby causing difficulties in]. This makes precisely arranging the predetermined particles between the layers difficult.

On page 3, replace the paragraph beginning at line 9 with the following rewritten paragraph:

D. In autoclave molding using the prepreg, the use of the prepreg having tucks requires deaeration between the prepreg layers during lamination, and a plurality of thin prepreg layers must typically be laminated together in order to obtain a structural material having a predetermined thickness.[, thereby requiring much labor] This is a labor-intensive process.

On page 3, replace the paragraph beginning at line 15 with the following rewritten paragraph:

[Weight lightening produces less economical effect due] Due to [a declining] the declining cost of crude oil, [and thus] aircraft makers are less inclined to purchase expensive light-weight materials. Accordingly, [aircraft makers strongly desire reduction in] a way of reducing the production [cost] costs of FRP structural materials is desired.

On page 3, replace the paragraph beginning at line 19 with the following rewritten paragraph:

[On the other hand] For example, a resin transfer molding (RTM) method [has recently attracted attention as a low-cost molding method], in which the mold cavity is filled with a laminate of a fiber reinforcing material, and then a resin is injected has recently attracted attention as a low-cost molding method. However, this method cannot precisely arrange the thermoplastic particles between the layers of the laminate, and [has difficulties in] forming a high-toughness FRP having excellent impact resistance [only by] is difficult without an improvement in the resin. In addition, when the fiber reinforcing materials are simply laminated, the materials in the layers are deviated from each other [to make] making it difficult to handle and disturb the fiber orientation, and thus FRP having predetermined mechanical properties cannot be easily obtained.

On page 4, replace the paragraph beginning at line 10 with the following rewritten paragraph:

[An object of the] The present invention [is to provide] provides a complex fiber reinforcing material having excellent shaping [property] properties and impact resistance after molding. [Another object of the] The present invention [is to provide] also provides a preform using the complex fiber reinforcing material and having uniform orientation of fibers, excellent handling property and impact resistance after molding. [A further object of the] The present invention [is to provide] further provides a method of producing a fiber reinforced plastic capable of producing FRP having excellent impact resistance and high reliability at a low cost.

On page 4, replace the paragraph beginning at line 20 with the following rewritten paragraph:

In order to achieve [the objects] this, the present invention has the following construction.

On page 8, replace line 15 with the following rewritten line:

[Best Mode for Carrying Out the Invention] Description of Preferred Embodiments

On page 9, replace the paragraph beginning at line 24 with the following rewritten paragraph:

In the uni-directional sheet or uni-direction non-crimp woven fabric comprising reinforcing fibers oriented in one direction, the reinforcing yarns are preferably oriented in parallel at intervals of about 0.1 to 5 mm to improve the fluidity of a [rein] resin in RTM molding or vacuum bag molding[,] and increase the resin impregnation rate.

On page 14, replace the paragraph beginning at line 20 with the following rewritten paragraph:

In the present invention, weight per unit area of the non-woven fabric is preferably 5 to 30 $g/m^2$. With a non-woven fabric having weight per unit area lower than the lower limit of this range, the amount of the fibers of the non-woven fabric, which serve as interleaves between the layers of the FRP material is decreased [to make it] making it difficult to obtain [the sufficient effect of improving] improved toughness. While with a non-woven fabric having weight per unit area over the upper limit of the above range, the ratio of the fibers, other than the reinforcing fibers, in FRP is increased [to] undesirably [deteriorate] deteriorating the mechanical properties such as strength and elasticity modulus.

On page 15, replace the paragraph beginning at line 7 with the following rewritten paragraph:

In arranging a sheet-shaped material in a mold having a complicated shape without wrinkling, i.e., fitting the material therein, the fiber positions are partially deviated in a bent portion of the mold, or the crossing angle of the fibers [changes] change. Therefore, the complex fiber reinforcing material must have freedom for deformation. For example, in[use of] using

paper or a film instead of the non-woven fabric, the complex fiber reinforcing material is wrinkled in fitting to the bent portion because of no freedom for deformation. In the wrinkled material, the reinforcing fibers are bent at the wrinkled portion to weaken the strength of the wrinkled portion of FRP, thereby undesirably causing the starting point of breakage.

On page 21, replace the paragraph beginning at line 24 with the following rewritten paragraph:

The difference between the melting points of the polymers of the core and the sheath is preferably 50°C or more. This is because with a difference lower than the lower limit of this range, the [different] difference between the melting points of the core polymer and the sheath polymer is small, and thus the polymer of the core is also melted in melting the polymer of the core. In addition, the molecular orientation of the core is disturbed to decrease the effect of improving the impact resistance by the polymer of the core.

On page 26, replace the paragraph beginning at line 12 with the following rewritten paragraph:

Fig. 8 is a sectional view of an example illustrating the method of molding FRP of the present invention. In Fig. 8, a predetermined number of complex fiber reinforcing material layers 1 are laminated on a mold 14 in a predetermined direction, and a sheet which is peeled after curing a resin, i.e., a peel ply 16, is laminated thereon, and a medium is placed on the peel ply 16, for diffusing the resin over the entire surface of the complex fiber reinforcing material. Also, an edge breezer 19 comprising a laminate of a plurality of porous material layers of woven fabric or the like, and an air suction port 18 of a vacuum pump is provided around the preform, the whole structure is covered with a bag film 20, and the periphery of the bag film 20 is bonded with a sealing material 21 to prevent air leakage. Furthermore, a resin discharge port 22 is mounted on the top of the back film, for injecting the resin from a resin tank, and the mounting

portion is bonded with the sealing material 21 to prevent air leakage. The resin tank contains a room temperature curing thermoplastic resin which contains a predetermined amount of curing agent, and which is syrupy at normal temperature. The preform covered with the bag film is brought into a vacuum state at vacuum pressure of about 93310 to 101325 Pa by the vacuum pump, and then a valve 15 is opened to inject the resin. Since the inside of the bag film is in a vacuum state, and the resin flow resistance in the thickness direction of the preform is higher than that in the planar direction of the medium, the resin first spreads over the entire surface of the medium, and then impregnation in the thickness direction of the preform proceeds. In this method, the distance of a necessary resin flow corresponds to the length of the preform, and thus resin impregnation is rapidly completed. The vacuum pump is preferably operated to maintain the inside of the bag film in a vacuum state at least until the resin impregnation is completed. After resin impregnation is completed, the valve is closed, and the resin is cured by allowing the resin to stand at room temperature. After the resin is cured, the peel ply is peeled to remove the medium and the bag film, and the reform is removed from the mold to obtain a FRP molded product.

On page 28, replace the paragraph beginning at line 2 with the following rewritten paragraph:

Fig. 9 shows an example of the medium 17 used in the present invention. The medium is used for transmitting the vacuum pressure in the bag film to the preform, and diffuses the injected resin over the entire region of the medium side surface of the preform by passing the resin through the spaces of the medium. Namely, when the resin is injected into the medium located between the bag film and the peel ply, in Fig. 9, the injected resin flows through the spaces between the bars 23 of group A adjacent to the bag film in the direction of the bars 23, and at the same time, the resin flows through the spaces between the bars 24 in group B having a rectangular sectional shape in the direction of the bars 24 to diffuse the resin in all directions.

Since the force acting on the bar 23 can be transmitted to the bars 24, the vacuum pressure can be transmitted to the preform. Examples of the medium include mesh sheets made of polypropylene, polyethylene, polyester, polyvinyl chloride, metals, and the like. For example, a [rein] resin mesh film, a woven fabric, a net, a knit fabric, and the like can be used, and a lamination of some of these materials can be used according to demand.

**In the Claims:**

Claims 1-3, 5, 7-13, 15, 19 and 22 have been amended as follows:

1. (Amended) A complex fiber reinforcing material comprising a sheet-formed fiber reinforcing material [composed of] comprising reinforcing fibers, and a non-woven fabric [composed of] comprising short fibers, [and] wherein the non-woven fabric is laminated [on] onto at least one side of the fiber reinforcing material[,] and wherein the short fibers [constituting the non-woven fabric] pass through the fiber reinforcing material to integrate the fiber reinforcing material with the non-woven fabric.

2. (Amended) A complex fiber reinforcing material comprising a sheet-formed fiber reinforcing material [composed of] comprising reinforcing fibers, and a non-woven fabric laminated on at least one side of the fiber reinforcing material, wherein the non-woven fabric is integrated with the fiber reinforcing material by a pressure sensitive adhesive.

3. (Amended) A complex fiber reinforcing material comprising a sheet-formed fiber reinforcing material [composed of] comprising reinforcing fibers, and a non-woven fabric laminated on at least one side of the fiber reinforcing material, wherein [the fibers constituting] the non-woven fabric [contain] contains 5 to 50% by weight of low-melting-point fibers, and the fiber reinforcing material is integrated with the non-woven fabric by heat bonding.

5. (Amended) A complex fiber reinforcing material according to any one of Claims 1 to 3, wherein the [size of the ] reinforcing [fiber yarns] fibers of the fiber reinforcing material [is] have a yarn size of 550 to 23000 decitex.

7. (Amended) A complex fiber reinforcing material according to any one of Claims 1 to 3, wherein the [woven] fiber reinforcing material comprises a woven fabric [constituting the fiber reinforcing material has] having a cover factor of 95% or more.

8. (Amended) A complex fiber reinforcing material according to any one of Claims 1 to 3, wherein the non-woven fabric contains low-melting-point fibers [composed of] comprising a thermoplastic polymer having a low melting point.

9. (Amended) A complex fiber reinforcing material according to any one of Claims 1 to 3, wherein the non-woven fabric [contains] comprises conjugate fibers comprising a core at a ratio of 30 to 70% of the sectional area of the conjugate fiber.

10. (Amended) A complex fiber reinforcing material according to Claim 9, wherein each of the conjugate fibers comprises the core [composed of] comprising nylon 6 or nylon 66, and the sheath [composed of] comprising nylon copolymer.

11. (Amended) A complex fiber reinforcing material according to any one of Claim 1 to 3, wherein weight per unit area of the non-woven fabric is [in the range of] 5 to 30 $g/m^2$.

12. (Amended) A complex fiber reinforcing material according to any one of Claim 1 to 3, wherein the fiber reinforcing material comprises a uni-directional sheet comprising reinforcing yarns oriented in [the] a length direction of the [length of the ] material.

13. (Amended) A complex fiber reinforcing material according to any one of Claims 1 to 3, wherein the fiber reinforcing material comprises a uni-directional woven fabric comprising reinforcing yarns oriented in [the] a length direction [of the length] of the material, and auxiliary yarns thinner than the reinforcing yarns and oriented in [the] a width direction of the material, to form a woven structure.

15. (Amended) A complex fiber reinforcing material according to any one of Claims 1 to 3, wherein the fiber reinforcing material comprises a bi-directional woven fabric comprising reinforcing yarns oriented in [the] a length direction and [the] a width direction of the material to form a woven structure.

19. (Amended) A complex fiber reinforcing material according to any one of Claims 1 to 3, wherein the [void ratio of the] non-woven fabric [is] has a void ratio of 30[%] to 95% of the total area of the non-woven fabric.

22. (Amended) A preform according to Claim 21, wherein the fiber reinforcing material layers are integrated with each other by heat bonding [of the] low-melting-point fibers contained in the non-woven fabric.